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(54) IMPROVEMENTS IN OR RELATING TO METHODS OF AND APPARATUS FOR SETTLING A PRODUCT IN A PACKAGE FORMED FROM A CONTINUOUS TUBE

(71) We, THE WOODMAN COMPANY, INC., a Corporation of the State of Georgia, United States of America, 114 New Street, Decatur, Georgia, United States of America,

do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to packaging methods and apparatus and, more particularly, to an improved arrangement for packaging wherein the product is more efficiently settled in the package being formed.

In the form and fill packaging process with which the present invention is primarily concerned, a continuous web of sheet material is transformed into a tube by passage over a former. As is well known, the product being packaged is introduced into the open end of the tube in weighed charges or batches with transverse seals being formed below and above said charge to complete the package which is then severed from the continuous tube. In packaging relatively light and irregularly shaped products, such as potato chips, there is presented a problem of getting the product compactly settled into the package so that it will not interfere with the forming of the top heat seal and so that the package will have a uniform and more pleasing shape.

One device previously used for performing this function included a pair of opposed stripper plates which are brought together against the tube to flatten the same whereupon relative movement between the tube and the plates along the longitudinal axis of the tube is performed so that the product is forced down into the package. This arrangement, while having been proven to be acceptable to successfully remove the product from the seal area and to shape the package, is subject to certain shortcomings. Need for improvement has been pinpointed in such areas as shortening of the cycle time by successfully eliminating the need for relative movement between the tube and sealing jaws of more than one package length, correction of the problem of bursting of packages along the bottom seal during the stripping operation by reducing the severity of the action, and reducing the breakage of the product that occurs with frangible products, such as potato chips, by eliminating forcible movement of rigid members against the product in the package.

While the basic stripping method and apparatus has been improved recently, as set forth in U.S. Patent Application entitled Brush Product Stripper, filed in the names of Duncan B. Cutler and Donald R. Middour, Serial No. 707,607, filed February 23, 1968, which application is assigned to the same assignee as the present invention, it has been found that there are certain packaging environments which dictate a solution to the settling problem that completely eliminates stripping. To explain, the stripping operation is performed by acting exclusively on the top of the package, so that while this operation is highly effective to remove unsettled chips from the top portion of the bag, experience has shown that much is left to be desired with regard to any unsettled chips that might be present in the bottom of the bag. Thus, in environments where there is a high incidence of unsettled bottom chips, a need exists for an improved method and apparatus that is especially designed to insure settling of these bottom chips. This design objective has been approached by the present invention through reliance on a positively induced vibratory shifting of the product within the package, as distinguished from prior art stripping

operations, which rely heavily, if not solely, on a downward pushing action on the chips.

The need for departure from stripping and adoption of this vibratory shifting concept is most prevalent when packaging product in the smaller bags, such as one ounce size bags, since the large chips are more likely to bridge across the bottom of the smaller width packages causing an unsettled condition. Furthermore, the small weight of the charge of chips for small bags is usually insufficient to cause a full spreading of the bag adjacent the bottom seal as the charge initially falls into position thereby adding to the causation of the unsettled condition.

Accordingly, it is one object of the present invention to provide a method and apparatus for settling of product in a package formed by a sheet material tube which is particularly adapted for situations where a stripping operation is inappropriate.

It is another object of the present invention to provide an improved packaging method and apparatus wherein the above mentioned problems are minimized in particular packaging environments, such as wherein small packages are being formed and filled.

It is still another object of the present invention to provide an improved form and fill packaging arrangement wherein the settling operation is performed solely by positively induced vibratory movement of the package and thus of the product within the package.

In previous nonstripping arrangements wherein is utilized the concept of vibrating the product to cause a settling within the package, it has been the practice to apply only a single stage action to each package. While this prior method is capable of causing a generally acceptable level of performance on particulate material like grain, such an arrangement is not adapted for use with products having larger and irregular pieces, such as potato chips. This is so since the irregular shape of the chips and their relatively rough surface prevent them from shifting position and seeking a nested relationship within the package as easily as particulate material does. Most importantly, the chips in the top of the bag which will interfere with the successful forming of the top seal would be left virtually uneffected in prior vibratory settling operations of which we are aware, due to the remoteness of the vibrating device from the top of the package and the lack of a positive gripping of the package.

Accordingly, it is another object of the present invention to provide an improved settling operation for difficult packaging circumstances as described wherein vibrating action is applied to the package in two separate stages including (1) presettling of the product in the bottom of the package and (2) subsequently, performing a final settling operation on the entire product charge adjacent the top of the package.

It is also an object of the present invention to provide a settling method and apparatus wherein the package is positively gripped at the bottom and top thereof in sequence by the vibrating mechanism to cause a more vigorous movement of the total product within the package to induce more efficient settling.

Still another object of the present invention is to provide a particularly advantageous settling motion wherein irregular product, such as potato chips, is urged to find a nested position and thereby form a compact charge.

According to the present invention, a method of settling a product in a package formed from a tube of sheet material held in an upright position comprises the steps of gripping opposite sides of said tube to form a temporary seal, vibrating said tube at said temporary seal, feeding said product above said temporary seal to be presettled by the vibrating action, releasing the tube so as to allow the presettled portion of the product to drop as a whole to a transverse bottom seal formed below and adjacent said temporary seal and regripping and reapplying vibration to said tube above said charge for additional vibrating action and final settling of said product in the top of said package.

According to a further feature of the invention a method of packaging a product in a package formed from a tube of sheet material held in an upright position comprises the steps of applying a pair of gripper members on opposite sides of said tube to temporarily seal the same, rapidly moving said gripper members back and forth while gripping said tube to vibrate the same, feeding said product above said members to be presettled by the vibrating action, applying a pair of sealing jaws across said tube to form a first transverse seal at a sealing station below said members, removing said members from engagement with said tube in timed relationship with and just prior to the formation of said first transverse seal to terminate the vibrating action on said tube and allow the presettled product to drop to the bottom of the package above said first transverse seal, relatively moving said tube with respect to said gripper members to provide a new length of tube above said transverse seal equal to the package being formed, reapplying said gripper members to the top of said new length of tube while moving the same back and forth for additional vibrating action and final settling of said product, and reapplying said sealing jaws across said tube at the top of

said new length of tube to form a second transverse seal above said product along with withdrawal of the gripper members and thereby complete said package.

In accordance with additional features of the present invention, the clamp is moved along an arc having a center axis extending transversely to but spaced from the longitudinal axis of the tube and opposite the gripper members, so that the tube is given a positive movement along an oscillatory path in an up and down direction. This is of importance since it provides a multiple component force to encourage settling of the product, i.e., the product within the tube is not only moved up and down but also from the rear of the package to the front by centrifugal force. Particularly advantageous settling action occurs as a result of the repetitive loosening and compressing forces resulting mainly from the rapid downward movement of the package, followed by the positive and somewhat abrupt stop at the bottom and the following upward return stroke. In essence, the chips, having been loosened by their tendency to remain at rest as the package moves downwardly, are free to shift position into the desired nested mode as they are compressed by the multiple G force that is applied at the bottom and on the return stroke.

In accordance with certain structural features of the vibrating mechanism of the invention, the gripper members are carried on pivotal arms for movement toward and away from the tube with the pivot axes of the arms being carried for bodily vibrating movement by an integral supporting frame. Advantageously, at least one of the gripper members is fabricated from resilient material to give a uniform clamping pressure across the tube.

The actuator cylinder for moving the gripper plates toward and away from the tube is mounted on the stationary frame of the machine and not on the oscillating frame so as to maintain the mass of said oscillating frame at a minimum. Of further interest is the rigid construction of the frame, which preferably comprises a pair of spaced supports with an interconnecting columnar member that serves to pivotally mount the assembly on an elongated pivot shaft extending across the full width of said frame for maximum stability. The gripper plate supporting arms are U-shaped for two point connection to the spaced supports whereby uniform gripping pressure across the tube is assured. With the interconnecting feature of the oscillating supports, the drive may be conveniently imparted by a single oscillating drive lever on one of the supports, which lever may conveniently be operated from an eccentric on a drive shaft mounted within the confines of the packaging machine.

Still other objects and advantages of the present invention will become readily apparent to those skilled in this art from the following detailed description, wherein we have shown and described only the preferred embodiment of the invention, simply by way of illustration of the best mode contemplated by us of carrying out our invention. As will be realized, the invention is capable of other and different embodiments, and its several details are capable of modification in various obvious respects, all without departing from the invention as defined in the claims. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not as restrictive.

Figure 1 is a diagrammatic showing of a form and fill arrangement capable of utilizing the principles of the present invention;

Figures 2—5 are diagrammatic showings of the sequence of operation following the showing of Figure 1, which operation is in accordance with the principles of the present invention;

Figure 6 is a front view of the apparatus of the present invention positioned within a form and fill packaging machine for carrying out the principles of the present invention;

Figure 7 is a cross-sectional view taken along line 7—7 of Figure 6 showing the clamp actuating and vibrating mechanism;

Figure 8 is a fluid circuit diagram showing the manner in which the apparatus of Figures 6 and 7 is controlled in accordance with the invention; and

Figures 9 and 9a are enlarged views of the vibrating clamp and tube showing the forces acting on the product during the positive upward and downward movement of said tube, respectively.

The form and fill arrangement of Figure 1 is an environment in which the method and apparatus of the present invention can be applied to advantage. Specifically, a form and fill apparatus 10 is illustrated which comprises a web W of sheet material, such as Glassine, Cellophane (both Registered Trade Marks) or polyethylene film, from which a continuous tube T is formed by passing said web W through a plurality of guide rollers R and then up and over a conventional winged former 1. As the tube T is completed, the opposite side edges are heat sealed by a die 12 to form the longitudinal seam in a conventional manner. The open end of the tube T is provided with a conventional filling tube 13 through which the product being packaged is transferred from a conventional weighing hopper 14.

For ease of description, the product being packaged in this particular instance has been represented by potato chips, as indicated by the reference numeral 15, and although it should be understood that the

settling method and apparatus of the present invention is particularly adapted for use with this product, other similar products could be packaged as well. The step of the packaging method or operation of Figure 1 insofar as the present invention is concerned is where the product 15 has been previously presettled within a lower package P, and said package P is being completed by a final settling operation. The settling action is of a vibratory nature, as noted by the arrows in this figure, which action is positively induced in the tube T by a clamp C that includes a pair of gripper members 16, 17 positioned on opposite sides of said tube T so as to flatten and grip the same. A transverse bottom seal has just been formed by a pair of sealing jaws 18, 19, with a new length D of tube T for the next successive package P_1 having been drawn by downward movement of said jaws 18, 19 while engaged with the tube T. Simultaneously with the initiation of the final settling process on the package P, the next charge of product 15 is just being introduced into the package P_1 above the clamp C, which forms a temporary seal in the tube T to keep the successive charges separated. As is shown in Figure 1, upon first entering the tube T, the product 15 is loosely spaced so that it extends along the tube for more than the one package length D, which, as will be recognized, would interfere with the operation of the sealing jaws 18, 19 when the upper transverse seal is to be made.

Thus, proceeding to describe the presettling operation and referring to Figure 2, the product 15 is being continuously shifted within the package P_1 by a vigorous, positive movement of the clamp C. As will be seen later in detail, the movement of the gripper members 16, 17 of said clamp is preferably in the up and down direction whereby maximum settling action is obtained due to a rapid repetitive loosening and compressing action of said product 15 within the tube T. Since the members 16, 17 are adjacent the bottom of the package P_1, a maximum flexing action of the sides of the tube T is obtained to further encourage shifting of the product in this area so that the chips adjacent the bottom of package P_1 are being efficiently presettled. It will be remembered that this is of primary importance, especially when small bags are being formed, due to the greater tendency of the bottom chips to remain unsettled under this condition.

The feature of the apparatus of the present invention relating to the efficient flexure of the sides of the tube T should be briefly noted here. To explain, the gripper member 16 of the clamp C is in practice made of a rigid material so as to generally resist flexure at the limits of the vibratory motion. This rigidity in turn induces vigorous jerking of the walls of the tube T at the limits of the vibratory motion for maximum flexure or outward bulging of the tube T adjacent said clamp C, as will be explained more fully in the discussion of Figures 9 and 9a. The gripper member 17 on the other hand is fabricated of resilient material so as to conform to the face of the member 16 and give a uniform gripping pressure across the width of the tube T, thereby insuring a firm grip on the tube T and preventing slipping under the jerking action.

The sealing jaws 18, 19 may now be brought together in Figure 3 at sealing station S to form the top seal of the package P and the bottom seal of package P_1 without fear of any chips in the package P interfering with the formation of the seal since the product 15 of the package P has now been finally settled through the action taking place in Figures 1—3. As just explained, a substantial amount of the product in package P_1 has also been settled and is advantageously retained above the sealing station S by the temporary seal formed by the clamp C gripping the tube T so that the chips in the package P_1 also do not interfere. That is, the sealing jaws 18, 19 are brought together and allowed to form the permanent heat seal while the product 15 for the package P_1 is safely isolated in spaced relationship above said sealing station S.

This isolation is accomplished in the present invention while also insuring that the vibration of the tube T has stopped just prior to the final engagement of the sealing jaws which is also necessary for maintaining the maximum integrity of the seal. Specifically, release of the vibrating gripping members 16, 17 takes place in timed relationship with and just prior to closing of said jaws 18, 19. This allows the product 15 to fall the relatively short distance from the area of the temporary seal, where it has been presettled by the vibrating action, and drop as a whole to the transverse bottom seal of the package P_1 during the time interval during which the jaws 18, 19 are finally closed (note relationship of Figure 3).

As shown in Figure 4, as the members 16, 17 reach their outward position, the transverse bottom seal has been completed by the final closing of the sealing jaws 18, 19, and said jaws 18, 19 are ready to begin their downward drawing stroke to present the new length D. The members 16, 17 remain in the same position with respect to the longitudinal axis of the tube T during this operation so that the top of the package P_1 is positioned at the sealing station S and the members 16, 17 are ready to grip just above this position, as shown in Figure 5. It is evident that the vibrating action on the tube T ceases during the drawing stroke so that the drawing of the new length D is smooth

and without hindrance. With the sealing jaws 18, 19 at the bottom of their stroke, the package P is severed from the remainder of the tube T as is conventional.

Returning now to the vibrating steps set forth in Figures 1—3, it should be clear that the package P_1 now occupies the position of package P and is ready for the final settling action. At this point, the reapplication of the clamp C to the tube occurs at the top of the package so that the vigorous agitation of the chips, assisted by the flexing of the walls of the bag, takes place thus insuring in particular that the chips in the top portion are settled. By the time that the sealing jaws 18, 19 come together to form the top transverse seal of the package P in the final settling operation, all of the chips have compactly and neatly nested together so as to free the area of the tube at the sealing station S of any chips from below and to give the package the desired pleasing appearance.

It should be recognized by those skilled in the art that the two stage positively induced vibratory settling of the product 15 is thus carried out without increasing the cycle time of the conventional form and fill machine since the vibrating action occurs while the sealing jaws 18, 19 are returning to the sealing station S which is necessary in any case. Perhaps of greater significance is the fact that breakage of the chips has been reduced to a minimum since the only force acting on the chips is due to the interaction with the surrounding chips and the flexible side walls of the package. Further, since stripping has been completely eliminated from the settling operation, there is no increase in air pressure within the package and no forceful action on the chips which tends to cause not only this breakage of the chips but also bursting of the bottom transverse seal. Furthermore, the particular manner in which the tube T is vibrated is of significant importance in obtaining maximum settling action in the process which will be realized in conjunction with the discussion that follows of the preferred structural form of the apparatus of the present invention.

Thus, referring to Figures 6 and 7, the clamp C is illustrated mounted for operation on the tube T positioned in a packaging machine of the form and fill type. Typically, the frame of the packaging machine comprises a horizontal member 21 from which spaced mounts 22, 23 depend downwardly towards a conventional reciprocating sealing jaw carriage 24. As shown, this positioning of the mounts 22, 23 places the clamp C between the side guideways 25, 26 which carry the slides 27, 28 of the carriage 24. As is well known, the slides 27, 28 may be interconnected by transverse member 29 and a pivotal operating yoke 30 through which the carriage 24 is reciprocated by chain drive 31. As denoted by the dotted line outline, the sealing jaws 18, 19 are carried by the interconnecting transverse member 29 for movement toward and away from the tube T.

With composite reference now to Figures 6 and 7 of the drawings, a pivot shaft 35 is secured to and spans the distance between the depending mounts 22, 23 for supporting a U-shaped frame of the clamp C; said frame including a columnar or sleeve member 36 rotatably supported by said pivot shaft 35 and spaced support plates 37, 38 (see Figure 6). With the plates 37, 38 rigidly connected to said columnar member 36 by suitable welds around the apertured interface and the shaft 36 serving as a support across the full width, the frame is highly stable so that constant and vigorous vibrating action with short, precise strokes can be applied to the clamp C for maximum settling action. Improved service life is also gained from this stabilized construction due to the absence of parts that could become loose under the influence of this action.

The support plates 37, 38 extend forwardly and upwardly from the pivot shaft 35 (see Figure 7) and are widened at the upper end to form spaced supports for each of a pair of U-shaped arms 40, 41 that form the clamp C; this dual point support on plates 37, 38 insures maintenance of equal pressure and movement across the width of the clamp C to thereby prevent slippage and possible skewing during the vibration. The rear U-shaped arm 40 has an integrally formed lever arm 44 formed on one leg thereof to which is connected an actuating cylinder 45 to effect movement of said arm 40 toward and away from the tube T; the same movement being translated to the front arm 41 by mating gears 46, 47 fixed for movement with the respective arms 40, 41. So that the mass of the vibrating clamp C is minimized whereby less operating power as well as structural reinforcement is required, the actuator cylinder 45 is carried by the frame member 21 of the machine. The vibrating motion of the clamp C is accommodated by mounting said cylinder 45 for complementary motion by means of a collar 48 pivotally supported on support ears 49, 50 attached to the horizontal member 21.

The power for vibrating the clamp C is gained through a rearwardly extending drive arm 65 provided on the support plate 38. The lower end of a reciprocating drive rod 66 is attached to the free end of the drive arm 65 and is reciprocally driven by an eccentric 67 mounted on a horizontal drive shaft 68. Driving the drive shaft 68 is a pulley 71 which is driven in a conventional manner by a suitable belt 72 and driving motor M. As can be noted in Figure 7, the complete driving mechanism just described

is advantageously positioned completely within the confines of the machine on rearwardly extending bearing and support assemblies, generally designated by the reference numerals 75, 76, which are attached to the rear of the horizontal frame member 21 (note Figures 6 and 7).

As best shown in Figure 8 and the following Figures 9 and 9a, the gripper members 16, 17 are carried by the horizontal part of said arms 40, 41 and serve to flatten the tube T and grip the same when brought together, as was discussed in describing the method steps of Figures 1—5. Preferably, the gripper member 17 is fabricated of rubber or other flexible, resilient material so as to be capable of positively gripping the bag and imparting the vigorous agitating movement thereto without slippage, as mentioned above. Of importance to this feature is the fact that said gripper member 17 is mounted only at the edge opposite to the gripping edge in a cantilevered fashion whereby said member 17 is capable of substantial inward compressive movement against the member 16. In other words, the leaving of the gripping edge of the member unsupported in this manner is of importance to allow unrestricted compression over this length and thus give maximum and uniform gripping force regardless of any irregularities in or adjustment of the gripping edge of the member 16, which is substantially rigid. Furthermore, the bodily movement of the entire clamp C for the vibratory action insures that the gripper members 16, 17 remain firmly secured to the tube T so as to further reduce the chance of slippage. It will be realized that the gripper members 16, 17 impart a vibratory motion (Figures 9 and 9a) that flexes the side walls of the package so that the product 15 adjacent the area gripped can spread the tube (note bulges 80 in dotted line outline of Figure 9) and thus assist the chips in finding the desired nested position.

The important orientation of the parts of the clamp C with respect to the actuating and vibrating mechanism described above can best be seen by reference to Figure 8, wherein is depicted longitudinal axis L of the tube T which is substantially vertical and is intersected at 90° by a plane 85 passing through the pivot shaft 35 and the gripper members 16, 17. This means that the movement translated to the tube T is along a substantially vertical and oscillatory path, as indicated by the curved arrows in this figure, which gives the tube T and the chips within the same a multiple component force for increased settling action, as will presently be described in the further discussion of Figures 9 and 9a. The actuator cylinder 45 is positioned directly above the pivot shaft 35 so that longitudinal axis 86 of the cylinder 45 intersects said pivot shaft 35. This orientation allows the clamp C to maintain the required constant gripping force on the tube T at the gripping edges of the members 16, 17. In other words, as the clamp C moves along the oscillatory path indicated, the pivotal connection between the arm 44 and the piston rod of the cylinder 45 is allowed equal complementary movement to each side of the axis 86, thereby minimizing the tendency for the clamp C to be realeased during the vibratory movement.

With reference now to Figures 9 and 9a, a more detailed explanation of the forces acting on the chips within the tube T will be given. First, as the clamp C moves on its upward oscillatory stroke, as indicated by the arrow 90 in Figure 9, it will be clear from the foregoing description that the gripping members 16, 17 move upwardly, as indicated. As this takes place, the tube T will be rapidly accelerated in the upward direction, and due to the tendency of the product 15 within the package P_1 to remain at rest, the chips are compressed downwardly toward the temporary seal formed by the members 16, 17. This force is represented by the solid arrow 93 in this figure and is the primary settling force acting on the chips in this operative mode. Concurrently, a small but nonetheless significant force, as represented by the arrow 94, also acts on the chips due to the centrifugal force as a result of the tube T moving in an arc about the pivot shaft 35. The force 94 thus causes the chips to shift from the rear of the package P_1 (right-hand side of Figure 9) to the front so that a limited circulatory motion is set up. Under these conditions, the chips are more likely to be able to shift with respect to each other under the influence of the axially orientated primary force 93 since any blocking chips change position laterally during each vibratory cycle.

At the top of the stroke, the direction of movement of the tube T is reversed, as illustrated in Figure 9 and denoted by the dashed arrow 95, so that the primary movement of the clamp C is downwardly. In this mode, as a result of the tendency for the product 15 to remain at rest as the tube T is rapidly accelerated downwardly, the product 15 is significantly loosened by the multiple component force, represented by the dashed arrows 97, 98. This loosening mode is of importance since it not only allows the chips to shift position to complement the compressive mode, but also insures the chips cannot become interlocked and thus remain unsettled.

The maximum compressive action takes place at the bottom of the downward stroke (Figure 9) where it will be realized that a multiple gravitational or G force is acting on

the product 15 to compress the same together and force it to the bottom adjacent the temporary seal. As this alternate compressive and loosening action takes place in rapid sequence, the internal shifting of the chips and outward stretching of the tube T is encouraged by a flexing or bulging of the walls of the tube, as represented by dotted line bulges 80 in Figure 9 and briefly mentioned above. Also, as explained above, since the members 16, 17 grip each of the packages P, P_1 being formed first at the bottom and then at the top, the entire product 15 has a maximum settling action transferred thereto.

An attendant advantage to the rapid oscillating motion of the tube T and the accompanying shifting back and forth of the product 15 is the scrubbing or cleaning of the product within the bag to present a more desirable product to the customer. For example, when potato chips are being packaged, it is normal for small broken pieces to be intermixed with the whole chips due to breakage that occurs along the conveyor line. With the vigorous vibrating action of the tubes, these small pieces will be rapidly settled in the bottom of the bag by gravity. Furthermore, the chips sometimes pick up an excess of salt from residue on the conveyor which makes the chips very distasteful to the customer. As above, the constant shifting back and forth of the chips with respect to each other removes or shakes the excess salt from the chips and allows said excess to drop to the bottom of the bag where it remains out of the body of the chips eaten by the customer.

Returning to the showing of Figure 8, there is illustrated a control circuit 100 which is used with particular advantage to carry out the method of the invention with the described apparatus. Specifically, the system 100 includes a master control circuit 101 which through electrical leads 101a, 101b operates a pneumatic control valve 102 in timed relationship with solenoid 103 connected through leads 103a, 103b. The solenoid 103 serves to open gate 104 of the weighing hopper 14 through a conventional lever arrangement 105 when the clamp C is actuated, as shown. The control valve 102 is supplied with pressurized air from air source 106 and includes an exhaust orifice 107; said control valve 102 being of the double-acting type in that it alternately connects terminals 108, 109 to pressurized air from the source 106 and to the atmosphere through orifice 107. The terminal 108 is connected to the return side of cylinders 110, 111 by passages 112, 113, respectively, for retracting respective sealing jaws 18, 19; whereas, the respective work sides of the cylinders 110, 111 are connected to the opposite terminal 109 through passages 114, 115.

In accordance with the preferred embodiment of the present invention, the actuator cylinder 45 for the arms 40, 41 of the clamp C has its primary side connected to the return side of the control valve 102 at the terminal 108 through a tube 120. A one-way delay valve 121 is provided to allow instantaneous flow of pressurized air toward the cylinder 45 (note solid arrow) but delayed flow from the cylinder 45 (note dashed line arrow); the latter being in response to a return spring 125 upon exhausting of the primary side through the valve 102 and the exhaust orifice 107. The time interval for delay may be regulated by handle 121a on the valve 121.

Thus, in operation, the step of Figure 1 and as held in Figure 2 (same as Figure 8) is accomplished in response to the master control circuit 101 actuating the control valve 102 to apply pressure to the return side of the cylinders 110, 111 through the passages 112, 113, respectively; and simultaneously, the passages 114, 115 are exhausted through orifice 107. At the same time, the cylinder 45 is actuated without delay through the tube 120 and the valve 121 to bring the gripper members 16, 17 into operative relationship with the tube T as shown. The master control circuit 101 is designed to actuate the gate solenoid 103 to open the gate 104 and allow the product 15 to enter the package P_1 at a selected time interval after the latter action has occurred. Thus, the product 15 does not enter until the gripper members 16, 17 have formed the temporary seal and no product can enter the seal area from above at the sealing station S.

At the crucial step of Figure 3, the work side of the cylinders 110, 111 is pressurized through the terminal 109 and the passages 114, 115, respectively, to move the jaws 18, 19 toward the tube T to form the transverse seal. In accordance with the invention, the actuating cylinder 45 although interconnected with the opposite terminal 108, which is now connected to the orifice 107 for exhausting the return side of the cylinders 110, 111, is not exhausted through the tubing 120 due to the pressure release delay feature of the valve 121. In other words, the primary side of the cylinder 45 is not exhausted so that the spring 125 opens the clamp C until the expiration of a selected time delay previously set by adjustment of the handle 121a. As previously mentioned and as illustrated in Figure 3, the delay should be selected so that the clamp C opens just prior to final closing of the jaws 18, 19. In this manner it is insured that the sealing jaws 18, 19 have not firmly gripped and sealed the tube T until the vibratory movement has stopped

while at the same time insuring that the presettled product 15 has not had time to traverse the distance between the temporary seal formed by the clamp C and the sealing station S to thereby eliminate the possibility of getting product within the seal to destroy the effectiveness of the same.

In this disclosure, there is shown and described only the preferred embodiment of the invention, but, as aforementioned, it is to be understood that the invention is capable of various changes or modifications within the scope of the inventive concept as expressed by the accompanying claims. Also, while the apparatus and method of the invention are particularly adapted for use in an arrangement wherein small bags are being formed and filled for the reasons given, it will be clear that the same principles would be applicable and the same advantages gained wherein larger bags are being made so that the use in such an environment is contemplated to be within the scope of the claims.

WHAT WE CLAIM IS:—

1. A method of settling a product in a package formed from a tube of sheet material held in an upright position comprising the steps of gripping opposite sides of said tube to form a temporary seal, vibrating said tube at said temporary seal, feeding said product above said temporary seal to be presettled by the vibrating action, releasing the tube so as to allow the presettled portion of the product to drop as a while to a transverse bottom seal formed below and adjacent said temporary seal and regripping and reapplying vibration to said tube above said charge for additional vibrating action and final settling of said product in the top of said package.

2. A method of settling a product as in Claim 1 comprising the steps of applying a pair of gripper members on opposite sides of said tube to temporarily seal the same, rapidly moving said gripper members back and forth while gripping said tube to vibrate the same, feeding said product above said members to be presettled by the vibrating action, applying a pair of sealing jaws across said tube to form a first transverse seal at a sealing station below said members, removing said members from engagement with said tube in timed relationship with and just prior to the formation of said first transverse seal to terminate the vibrating action on said tube and allow the presettled product to drop to the bottom of the package above said first transverse seal, relatively moving said tube with respect to said gripper members to provide a new length of tube above said transverse seal equal to the package being formed, reapplying said gripper members to the top of said new length of tube while rapidly moving the same back and forth for additional vibrating action and final settling of said product, and reapplying said sealing jaws across said tube at the top of said new length of tube to form a second transverse seal above said product along with withdrawal of the gripper members and thereby complete said package.

3. A method as in Claim 1 or Claim 2 wherein the step of rapidly moving said gripper members is carried out in the up and down direction whereby maximum settling action is applied due to repetitive loosening and compressive action on said product.

4. A method as in Claim 2 wherein said step of rapidly moving said gripper members is carried out along an arc having a center axis extending transversely to but spaced from the longitudinal axis of said tube and opposite the gripper members so as to cause said tube to move in an oscillatory path, whereby centrifugal force is applied to said product to encourage settling.

5. A method as in any one of Claims 1 to 4 wherein the vibrating step is performed only during a portion of the time that the said tube is gripped.

6. Apparatus for settling product in a package formed from a tube of sheet material held in an upright position and having a transverse bottom seal comprising a frame mounted for oscillatory motion about an axis extending transversely to but spaced from the longitudinal axis of said tube, a pair of arms mounted on said frame for movement toward and away from said tube on opposite sides thereof, gripper plates carried by said arms for positively gripping said tube when said arms are moved toward said tube, means for moving said arms toward and away from said tube, and means for oscillating said frame to impart bodily movement of said tube along an arc to settle said product.

7. Apparatus as in Claim 6 wherein at least one of said gripper plates is resilient and mounted on its respective arm so as to give a uniform gripping pressure across the width of the tube.

8. Apparatus as in Claim 6 or Claim 7 wherein said pivotal axis of said frame lies opposite said gripper plates whereby the greater component of movement of said gripper plates is obtained in the up and down direction whereby maximum settling action is applied due to repetitive loosening and compressive action on said product.

9. Apparatus as in any of Claims 6 to 8 wherein said arms are pivotally mounted said means for moving said arms toward and away from said tube include an actuator cylinder attached to said arms and mounted

for pivotal movement about a fixed axis, said pivotal mounting of said cylinder serving to accommodate the vibrating action of said frame.

10. Apparatus as in Claim 9 wherein said actuator cylinder is mounted along a plane extending through said pivotal axis and substantially parallel to the longitudinal axis of said tube whereby said oscillatory motion of said arms on said frame is substantially unimpeded by said cylinder.

11. Apparatus as in any of Claims 6 to 10 wherein said frame includes a pair of spaced support plates, a columnar member rigidly interconnecting said spaced plates, said columnar member being mounted on a pivot shaft for coordinated oscillatory motion of said frame, said pivot shaft extending the full width of said frame for stability.

12. Apparatus as in Claim 11 wherein said means for vibrating said frame includes a motor, a drive shaft driven by said motor, eccentric means on said drive shaft, a reciprocating drive rod connected to said eccentric means, and a drive extension on one of said support plates of said frame connected to one end of said drive rod for imparting said oscillatory motion to said frame.

13. Apparatus as in any of Claims 6 to 12 wherein is further provided a pair of sealing jaws on opposite sides of said tube for forming said transverse bottom seal and a top transverse seal, fluid means for moving said sealing jaws alternately toward and away from said tube in the direction opposite to said arms, said means for moving said arms being interconnected with said fluid means for operation in response to the same and delay means for causing said arms to move away from said tube in timed relationship with and just prior to the engagement of said sealing jaws with said tube.

14. A method of settling a product in a package substantially as hereinbefore described with reference to the accompanying drawings.

15. Apparatus for settling a product in a package substantially as hereinbefore described with reference to the accompanying drawings.

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3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

FIG. 1

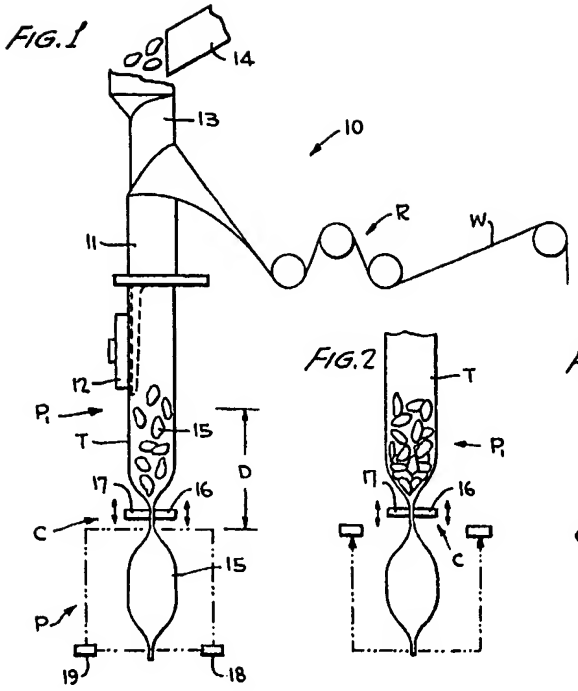

FIG. 2

FIG. 3

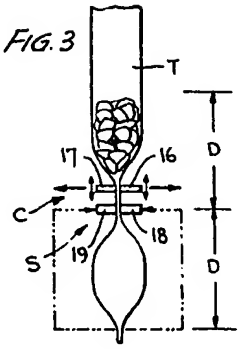

FIG. 4

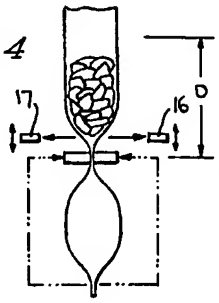

FIG. 5

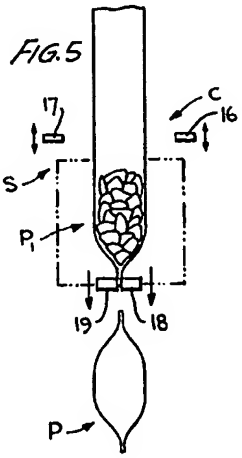

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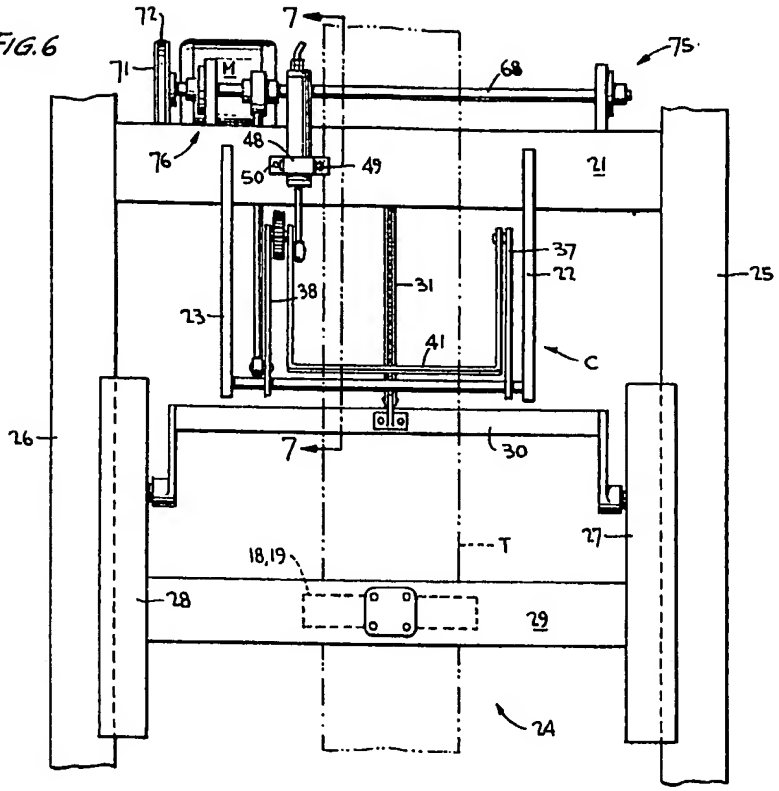
FIG. 6



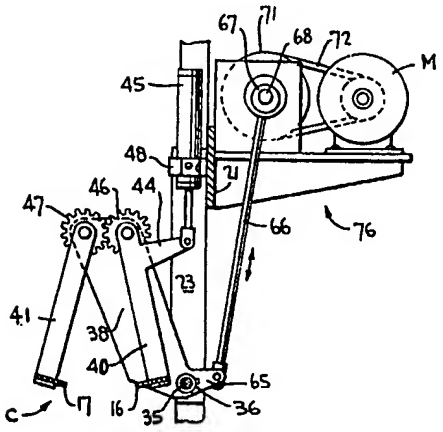


FIG. 7

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FIG. 8

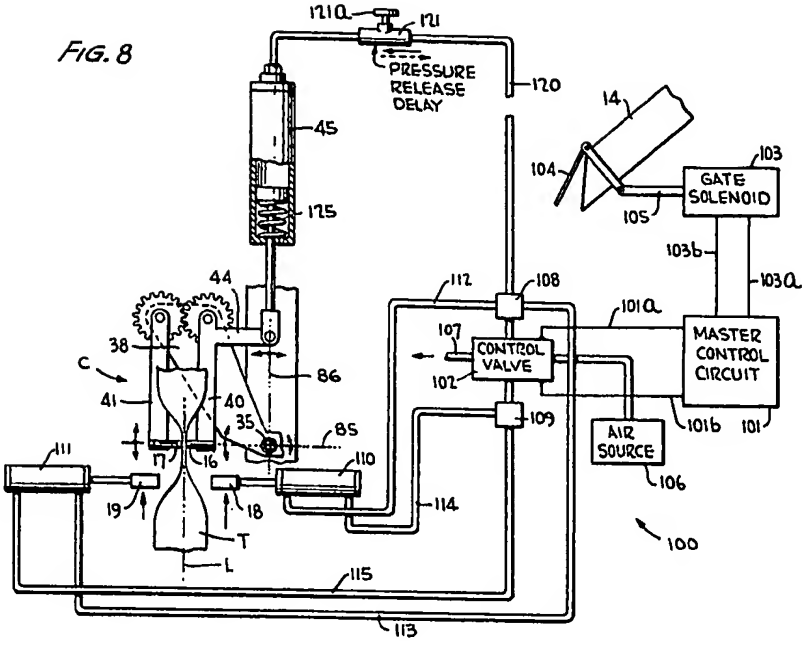

FIG. 9

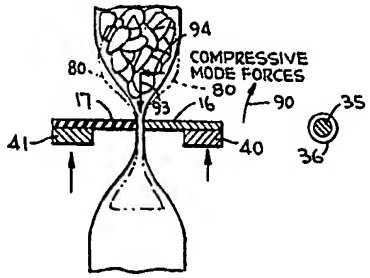

FIG. 9a